

REMARKS

This Paper is being submitted in response the Office Action dated May 17, 2004 regarding Patent Application Serial No. 09/803,802.

Claims 1-19 are pending in the application. Claims 1-2 and 4-19 stand rejected. Claim 3 stands objected to as being dependent upon a rejected base claim. The Applicant appreciates the indication of allowance with respect to Claim 3. Claim 20 has been added to incorporate the limitations of Claim 1 and Claim 3. No new matter has been added thereby. Figures 6, 9 and 10 stand objected to. The deficiencies of Figures 6 and 10 have been addressed through amendments to the Specification. Figure 9 has been amended and a replacement sheet has been provided with this Paper. Claim 19 was objected to - dependency has been changed.

Claims 1, 2, 4-9 and 14-19 stand rejected under 35 U.S.C. 102(e) as being anticipated by Szeliski, et al., U.S. Pat. No. 6,044,181, (hereinafter referred to as *Szeliski*). Claims 10-13 stand rejected under 35 U.S.C. 103(a) as being obvious over Szeliski in combination with Ray et al., U.S. Pat. No. 6,456,793 (hereinafter referred to as *Ray*).

Applicant respectfully requests reconsideration in view of the foregoing amendments and the remarks hereinbelow.

Rejection of Claims 1,2, 4-9 and 14-19 under 35 U.S.C. 102(e) - Szeliski

Szeliski teaches a method for focal length estimation for construction of panoramic mosaic images. Figure 3 illustrates a method for capturing a sequence of 2D still images as a camera is panned. Col. 9, lines 36-43. “Fig 3. illustrates a tutorial example in which a camera motion is restricted to a simple pure panning motion.” Col. 9, lines 34-37. In contradistinction to *Szeliski* and, in particular, to Figure 3 and the corresponding text thereof, Claim 1 teaches “acquiring a plurality of adjacent images of the scene, wherein there is an overlap region between the adjacent images and at least some of the adjacent images are range images.” Specifically, *Szeliski* fails to teach that “at least some of the adjacent images are range images” as is required by Claim 1. Contrary to the description given for a range image on Page 4 of the Office Action, “each having a focal length from the optical center”, the images in *Szeliski* are not range images

because the center rays of the images are focused on 3D points. The cited text in the Office Action refers to the 3D points which are at a focal length from the optical center point C, but that refers to how the 2D images were obtained to create a panorama and not a 3D panoramic image. A range image is defined in the Specification on Page 2, lines 8-10, as “Imaging systems that are capable of recovering range values at every pixel (full 3-D range recovery).” The images taught in *Szeliski* are not images that are capable of recovering range values at every pixel. Moreover, any image captured by a camera has some focal length from the optical center; hence, this factor alone does not make an image a “range image.”

Claim 1 further recites the steps of “providing offset data for the range images in order to recover corrected relative scene spatial information, wherein the providing offset data further comprises:

- (i) detecting a relative range difference between adjacent range images as a constant offset between the adjacent images;
- (ii) applying the constant offset to at least one of adjacent range images to correct for ambiguities in the relative ranges of the range images, thereby providing corrected range images; and
- (c) deriving a three-dimensional panorama from the corrected range images.”

Szeliski teaches, in Column 6, that a complete initial panoramic mosaic is assembled sequentially by “adding one image at a time and adjusting its position using a rotational motion model. A global alignment (block adjustment) is invoked to modify each images transformation (and focal length) such that the global error across all possible overlapping image pairs is minimized.” Lines 60-65. The global alignment is explained in Columns 19-24. As described in Column 20, *Szeliski* teaches closing the gap between the first and last images in a sequence by applying a least-squares solution with hard linear constraints for identified focal lengths and repeated frames after minimizing the difference between ray directions. Column 20, lines 42-47. Moreover, Column 21 describes the global alignment as applying to pairs of images only if a significant overlap of more than a quarter of the image size is affected. Column 21, Lines 1-3.

In contradistinction, Claim 1 provides for offset data for the range images to recover corrected relative scene spatial information. *Szeliski* does not address

range images as discussed above. Rather than providing offset data, *Szeliski* uses a method that applies mathematical functions to existing constraints. No offset “data” is provided. *Szeliski* operates to provide an image transformation by a spatial transformation which does not teach providing offset data.

Moreover, *Szeliski* fails to teach deriving a three-dimensional panorama from the corrected range images as required by Claim 1. Although Figure 3 illustrates focal points that are a fixed distance from a source, Figure 3 does not illustrate a three-dimensional image. The corresponding text makes clear that Figure 3 represents a camera taking several 2D pictures to create a panorama image and is not a range image type camera. See Column 5, lines 25-27. Moreover, the background section states in Column 1, lines 26-30, that the “present invention is particularly directed to image-based rendering systems without any depth information.”

Accordingly, *Szeliski* fails to teach either alone or in combination with other prior art “offset data for range images” or a “three-dimensional image” as taught by Claim 1. Claims 2-3 depend from Claim 1 and are allowable for at least this reason.

Regarding Claim 4, as described above, *Szeliski* fails to teach three-dimensional panorama views and, instead, teaches two dimensional images combined to create a panoramic image. Further, as described above, *Szeliski* fails to teach providing offset data for each image. Regarding spatial image information being in the (X,Y,Z) planes, Applicant respectfully disagrees that *Szeliski* teaches this element because Column 10, equation (2) of the reference defines a three dimensional equation intentionally neutered to contain only two dimensions by providing a constant value instead of a Z term to represent depth. Equations 3 and 4 use the neutered values to provide only X and Y terms. Therefore, there is no “warping the transformed (X,Y,Z) images onto a cylindrical surface and forming a plurality of warped (X,Y,Z) images” or “forming a three-dimensional (X,Y,Z) panorama using the warped (X,Y,Z) images.” as required by Claim 4. Thus, *Szeliski* fails to teach or suggest the limitations of Claim 4. Claims 5-13 depend from Claim 4 and are allowable for at least this reason.

Regarding Claim 14-15, the Applicant respectfully points out that the claims do more than “merely call for a system for performing the methods of claims 1 and 4.” In particular, Claim 14 requires a “panoramic three-dimensional

scannerless range imaging capture component" not taught in *Szeliski* and, likewise, Claim 15 requires "a three-dimensional panoramic capturing system, wherein a sequence of spatial (X,Y,Z) images and a sequence of intensity (R,G, B) images are produced". Claims 16 and 17 are Beauregard claims with similar limitations as provided in Claim 1 and Claim 4, respectively. However, "the scene" images are defined as having been generated "by a range imaging camera" which is not taught in *Szeliski*. Claims 18-19 depend from Claim 17 and are allowable for at least that reason.

Conclusion

Claims 1-19 are pending. Claim 20 has been added. The specification has been amended by replacement paragraphs. Figure 9 has been replaced. The rejection of Claims 1-2 and 4-19 has been traversed. Claim 3 has been canceled and Claim 20 has been added to include the limitations of Claim 1 and Claim 3.

It is respectfully submitted, therefore, that in view of the above amendments and remarks, that this application is now in condition for allowance, prompt notice of which is earnestly solicited.

Respectfully submitted,



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